SECTION SID - STORM DRAINAGE

SD.01 - REINFORCED CONCRETE PIPE

1. DESCRIPTION

A. This section covers precast reinforced concrete pipe and specials for storm drainage and sanitary sewer.

B. Include precasts; reinforced concrete pipe, pipe bends or elbows, and miscellaneous specials or accessories required for a complete installation as shown on the Drawings and specified herein.

2. QUAUTY ASSURANCE

A. Pipe manufacturer shall produce pipe of satisfactory quality and performance to meet the specifications herein.

B. SHOP TESTS
1) Concrete nonpressure pipe shall be tested in accordance with the applicable provisions of ASTM C 76.

C. Materials, fabricated parts, and pipe that are discovered to be defective or that do not conform to the requirements of these specifications will be subject to rejection at any time prior to final acceptance of the pipe. Rejected material and pipe shall promptly be removed from the site of the work.

D. Concrete pipe shall be precast or machine made and shall be the product of a concern that can demonstrate by tests and installation records satisfactory experience in manufacturing concrete pipe of the quality and type specified.

E. REFERENCED STANDARDS

1)	ASTM C 76	Reinforced concrete culvert, storm drain, and sewer pipe.
2)	ASTM C 361	Reinforced concrete low-head pressure pipe.

3. SUBMITTALS

A. SUBMIT
1) Full details of pipe, special joints, special pipe bends, and assembly thereof, including manufacturer's name.
2) Joint materials and details.
3) Catalogue cuts, dimensions and full details of all castings.
4) Reinforcing steel bending and setting drawings.
5) Certifications as specified herein.
6) Maintenance manuals.

B. CERTIFICATES
1) Submit two copies of certified records of tests of the pipe made by the manufacturer or a recognized testing laboratory with each pipe shipment.
2) Submit two copies of certified records of tests of joints.
3) All methods of testing, basis for rejection, and provisions for retests shall be in accordance with applicable specifications as stated herein.
4) At least two representative specimens of the pipe and the joints from each carload or partial carload delivered shall be tested.

4. PRODUCT DELIVERY, STORAGE AND HANDILING

A. Exercise care in transporting and handling to avoid damage to pipe and fittings.
B. Unload pipe, fittings and accessories from cars or trucks with hoists or by controlled skidding. Do not drop pipe.
C. Take care to prevent the pipe coatings from being damaged, particularly on the interior sections.
D. Store materials on the site so as to prevent damage.
E. Rubber gaskets shall be stored in a cool, dark location to avoid deterioration.

5. PIPE

A. All concrete pipe operating without internal hydrostatic pressure shall be precast reinforced concrete pipe meeting the requirements of ASTM C 76.
B. The class of reinforced concrete pipe shall be a minimum of Class 111, Wall B unless otherwise shown on the Drawings or listed in the Bid.
C. All reinforced concrete pipe shall be manufactured in lengths of not more than 20 feet and not less than 7 1/2 feet, except where shorter lengths are required for construction of curves in lines or at junctions with structures that cannot be adjusted in location.
D. Pipe shall be straight (except where pipe bends are utilized to accommodate changes in alignment), true in form, and of full diameter throughout.
E. Pipe shall be steam cured for a period of not less than 8 hours.
F. Exceptions to concrete materials as specified in ASTM C 76 are as follows:
    1) Cement shall be Portland Cement Type 11.
    2) Coarse aggregate shall be limestone or calcareous material.
G. All pipe furnished for use shall bear the name of the manufacturer, trade name, and class.

6. JOINTS

A The type of joint to*be furnished shall be dependent on the service for which the pipe is intended as listed below.
B. STORM DRAINAGE
    1) Pipe furnished for storm drainage shall be tongue and groove with no rubber gaskets required unless otherwise specified or shown on the Drawings.
    2) When required, storm drainage pipe joints shall be provided with gasketed joints meeting the requirement of ASTM C443.
C. SANITARY SEWER
    1) All non-pressure sanitary sewer pipe shall be of the bell and spigot type joint meeting the requirements of ASTM C443 for gasketed joints**.**
    2) Pipe joints shall be designed for the use of a compression type O-Ring gasket with steel joint rings.

7. EMBEDMENT MATERIALS

A. CLASS C1 EMBEDMENT
   1) BEDDING MATERIALS
      a. Shall be classified as fine granular material.
      b. Materials for fine granular bedding shall consist of well graded fine to course sands or gravel meeting the gradation requirements of ASTM C33 for fine aggregates.
      c. It shall be a natural material or artificial mixture, consisting largely of a mixture of sand and clay in proper proportions that are normally found in natural deposits in the project vicinity.
      d. The material shall generally pass a 3/8' sieve with no more than 15% passing a No. 200 sieve, and shall be non-plastic.
   2) INITIAL BACKFILL
      a. Acceptable material shall generally be a natural or artificial mixture of soil types normally found in natural deposits in the project vicinity or material obtained from the CONTRACTOR'S excavation.
      b. All material shall be suitable and free from roots, woodscape material, and other vegetable matter and refuse.
      c. All material shall be sufficiently dry for compaction and shall not contain excessive amounts of soft or highly plastic clays.
      d. Maximum size of stone shall not exceed three inches.

B. CLASS C2 EMBEDMENT
   1) BEDDING MATERIALS: Not required.
   2) INITIAL BACKFILL
      a. Acceptable material shall generally be a natural or artificial mixture of soil types normally found in natural deposits in the project vicinity or material obtained from the CONTRACTOR'S excavation.
      b. All material shall be suitable and free from roots, woodscape material, and other vegetable matter and refuse.
      c. All material shall be sufficiently dry for compaction and shall not contain excessive amounts of soft or highly plastic clays.
      d. Maximum size of stone shall not exceed three (3) inches.

C. CLASS B EMBEDMENT
   1) BEDDING MATERIALS
      a. Class I materials shall be angular, graded stone, including a number of fill materials such as slag, crushed stone, or cinders conforming to the requirements of ASTM D 2321. Aggregate shall be 1/4 inch to 1-1/2 inch in size.
      b. Class 11 materials shall be coarse sands and gravel including small percentages of fines, generally granular and non-cohesive, either wet or dry, conforming to the requirements of ASTM D 2321. Aggregate shall be of maximum particle size of 1 inch.
      c. Class III materials as defined in ASTM D 2321 shall not be used as embedment material.
   2) INITIAL BACKFILL
      a. Acceptable material shall generally be a natural or artificial mixture of soil types normally found in natural deposits in the project vicinity or material obtained from the CONTRACTOR'S excavations.
      b. All material shall be suitable and free from roots, woodscape material, and other vegetable matter and refuse.
      c. All material shall be sufficiently dry for compaction and shall not contain excessive amounts of soft or highly plastic clays.
      d. Maximum size of stone shall not exceed three (3) inches.

8. TRENCH CONSTRUCTION

A. Trench construction shall be performed in accordance with the requirements of Section GM-04 and as shown on the Drawings.

B. This Section covers the requirements for Embedment Construction only. Reference Section GM-04 for final backfill requirements.

C. The bottom of the trench shall be over-excavated when embedment Class B or C1 is required and brought to grade with embedment materials.

9. EMBEDMENT CONSTRUCTION

A. MINIMUM EMBEDMENT REQUIREMENTS
   1) Except where specifically required or approved by the ENGINEER or otherwise shown on the Drawings; Class C1 shall be provided for reinforced concrete pipe.

B. CLASS C1 EMBEDMENT
   1) The pipe shall be embedded in fine granular material on a trench bottom which shall be level in cross-section except that a continuous trough shall be shaped in the bedding which will bit the pipe barrel with reasonable closeness.
   2) The bedding shall have a minimum thickness beneath the pipe of 6 inches or one-eighth (1/8) of the outside diameter of the pipe, whichever is greater.
   3) The bedding shall extend up the sides of the pipe one-sixth (1/6) of the outside diameter of the pipe.
   4) Initial backfill material, which is from the bedding to one (1) foot above the pipe:
      a. Shall be carefully deposited in successive horizontal layers of not more than twelve (12) inches in loose depth on each side of the pipe.
      b. Shall be thoroughly and carefully tamped or rammed around the pipe with approved tools until reaching a cover of not less than one (1) foot over the top of the pipe.

C. CLASS C2 EMBEDMENT
   1) The pipe shall be bedded with 'ordinary' care in an earth foundation formed in the trench bottom by a shaped excavation which will fit the pipe barrel with reasonable closeness for a width of at least 50 percent of the outside pipe diameter.
   2) Initial backfill material, which is from the bedding to one (1) foot above the pipe.
      a. Shall be carefully deposited in successive horizontal layers of not more than twelve (12) inches in compacted depth on each side of the pipe.
      b. Shall be thoroughly and carefully tamped or rammed around the pipe with approved tools until reaching a cover of not less than one (1) foot over the top of the pipe.

D. CLASS B EMBEDMENT: (As Specifically Required)
   1) Class B Embedment shall be used where an unstable trench bottom condition is encountered or where established by the ENGINEER or where shown on the Drawings.
   2) The bottom of the trench shall be over-excavated and brought to grade with a layer of bedding materials. The undercut shall be six (6) inches below the pipe bottom, unless otherwise specified. When the undercut exceeds a depth of six (6) inches, the bedding shall be placed in equal lifts not exceeding six (6) inches.
   3) Class I bedding materials shall be utilized for B Embedments as the minimum bedding requirement. Class 11 bedding materials may be used only as specifically denoted on the Drawings or directed by the ENGINEER for use in certain areas
   4) Where Class I material is used for bedding, it must also be utilized for hunching at least up to the springline of the pipe. Class I bedding shall be provided to a depth

required to produce a firm foundation or as directed by the ENGINEER, but in no case shall the depth of Class I bedding be less than six (6) inches below the pipe line.

5) If Class 11 material is approved for bedding, it must also be utilized for hunching at least up to the springline of the pipe. Class 11 material shall be compacted to a minimum of 85% Standard Proctor. Class 11 bedding shall be at least six (6) inches in depth after compaction.

6) Initial Backfill material, which is from the bedding to one (1) foot above the pipe:
   a. Shall be carefully deposited in successive horizontal layers of not more than twelve (12) inches in loose depth on each side of the pipe.
   b. Shall be thoroughly and carefully tamped or rammed around the pipe with approved tools until reaching a cover of not less than one (1) foot over the top of the pipe.

10. PIPE ENCASEMENT

A. Where pipelines are required to be encased by concrete, the encasement shall be comprised of 2500 psi concrete.

11. PIPE INSTALLATION

A. Reinforced concrete pipe shall be installed to conform to the general requirements of this Specification and in accordance with the manufacturer's recommendation.

B. All pipe shall be laid up grade with the spigots pointing down grade.

C. The pipe shall be so laid in the trench that after the sewer is completed the interior surfaces conform to the grade and alignment as shown on the Drawings.

D. The use of a laser beam system or equal shall be used to control grade.

E. Gravity piping shall be on straight alignment, except for pipe bends, and constant grade between structures, unless otherwise shown on the Drawings.

F. Whenever water is present or work is completed for the day or any extended interval of time, block or plug all ends of pipe by the use of approved pipe plugs to prevent the entrance of water, sand, mud or other debris.

12. PIPE JOINTS

A. All surfaces of the factory-made jointing material shall be clean and dry.

B. Lubricants, primers, adhesives, etc., shall be used as recommended by the pipe or joint manufacturer's specification.

C. The jointing material or factory fabricated joints shall then be placed, fitted, joined, and adjusted in such a workmanlike manner as to obtain the degree of water-tightness required.

D. Where circular O-ring gaskets are used, the gasket shall not be stretched more than 20 percent nor less than 10 percent when placed on the spigot of the pipe.

E. Whenever a pipe requires cutting to fit the line or bring it to the required location, the fold cut pipe lengths shall be filed, beveled or ground to resemble the spigot end of such pipe as manufactured.

13. FINAL BACKFILL

A. All final backfill for trenches shall be in accordance with Section GM-04 of these Specifications unless otherwise specified under this Section.

14. CONNECTIONS

A. Lateral stub connections shall be placed as indicated on the Drawings or as directed by the ENGINEER.

B. All stubs shall be property stoppered and braced to prevent leakage.

C. The CONTRACTOR shall remove all bulkheads which have been left in place in existing sewers or structures, and shall make proper connections to these sewers and structures in the manner and at the locations indicated. He shall also make the necessary conduit, pipeline, and sewer connections where required.

15. SEWER ALIGNMENT

A- Maximum permissible variation in sewer alignment and grade shown on the Drawings shall be:

1) Alignment = ± 1-1/20 per 100 feet from the vertical plane.
2) Grade = ± 1 W per 100 feet from the horizontal plane.

16. INSPECTION AND TESTING

A. All pipe and fittings shall be subject to inspection and approved by the ENGINEER after delivery to the site. No broken, cracked, misshaped, imperfectly coated, unsatisfactory, or otherwise damaged pipe or fittings shall used.

B. Such inspection by the ENGINEER shall not relieve the CONTRACTOR of full responsibility for the material installed.

C. Before final acceptance of the piping system, the system shall be cleaned and flushed by means of rods and swabs or other instruments.

END OF SECTION - SD.01

SD.02 - CORRUGATED STEEL PIPE AND PIPE ARCH
QNCLUDING UNDERDRAIN)

1. DESCRIPT`ION

A. This Section covers corrugated steel pipe, including round culvert pipe, pipe arch and underdrain, and coupling banks for each type.

B. Include pipe fittings and miscellaneous specials or accessories required for a complete installation as shown on the Drawings and specified herein.

2. QUALITY ASSURANCE

A. Pipe shall conform to the requirements of AASHTO M 36, including the provisions for both circular and helical corrugations for the round culvert pipe and the pipe arch, and with the additional provisions contained herein.

B. Materials, fabricated parts, and pipe that are discovered to be defective or that do not conform to the requirements of these specifications will be subject to rejection at any time prior to final acceptance of the pipe. Rejected material and pipe shall promptly be removed from the site of the work.

3. SUBMITTALS

A. Submit catalog cuts or other data showing full details of pipe, special joints, special pipe bends, and assembly thereof, including manufacturer's name.

B. Submit two copies of certified records of tests of the pipe made by the manufacturer or a recognized testing laboratory as requested.

4. PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Exercise care in transporting and handling to avoid damage to pipe, fittings, and coatings.

B. Unload pipe, fittings and accessories from cars or trucks with hoists or by controlled skidding. Do not drop pipe.

5. ROUND CULVERT PIPE

A. For round culvert pipe, unless shown otherwise in the plans the minimum thickness of the metal (including the galvanizing), and the dimensions of circular corrugations, shall be as follows:

B. TABLE I - THICKNESS OF METAL FOR PIPE

Nominal Diameter (Inches)	Galvanized Sheet Game No.	Mean Thickness Galvanized Metal (Inches)
6	18	0.0516
8	16	0.0635
10	16	0.0635
12	16	0.0636
15	16	0.0635
18	16	0.0635

21	16	0.0635
24	16	0.0635
30	14	0.0785
36	14	0.0785
42	12	0.1084
48	12	0.1084
54	12	0.1084
60	10	0.1382
66	10	0.1382
72	10	0.1382
78	8	0.1681
84	8	0.1681
90	8	0.1681
96 AND OVER	8	0.1681

C. TABLE 11 - PERMISSIBLE VARIATION IN THICKNESS OF GALVANIZED METAL FOR PIPE AND CONNECTING BANDS

Galvanized Sheet Gauge No.	Mean Thickness of Galvanized Metal (Inches)	Permissible Variation (inches)
18	0.0516	0.007
16	0.0635	0.007
14	0.0785	0.008
12	0.1084	0.009
10	0.1382	0.009
8	0.1681	0.009

D. A corrugation pitch of 125 millimeters with a corrugation depth of 26 millimeters will be allowed as an alternate to the three-inch by one-inch corrugation providing that the provisions of AASHTO M 36 and AASHTO M 218 are met.

6. PIPE ARCH

A. For corrugated metal pipe arch, in addition to the requirements shown therefore in AASHTO M 36, thickness of the metal shall be as shown for the equivalent size round pipe in Tables I and 11, above, and the fabrication of the pipe arch sections shall be such as to ensure a substantially flat invert.

7. FIELD JOINTS

A. Corrugated steel pipe shall be field jointed with locking banks as specified in Articles 20.1, 20.2, 20.3, 20.4, and 20.5 of AASHTO M 36-70 and in accordance with the provisions specified in such articles.

B. Where corrugated steel pipe is used as cross drain, storm sewer, or gutter drain, the above specified banded joints shall be gasketed with a rubber or neoprene gasket of a design shown to secure a soiltight or watertight joint The gasket shall be of the following dimensions:

1) For annular joints with 1/2 inch depth corrugations: either a single gasket a minimum of seven inches by 3/8 inches or two gaskets a minimum of 3-1/2 Inches

by 3/8 inch; and for annular joints with one-inch depth corrugation: either a single gasket a minimum of seven inches by 7/8 inch or two gaskets a minimum of 3. 1/2 inches by 7/8 inch.

2) For helical joints with 1/2 inch depth corrugation: either a single gasket a minimum of five inches by one inch or two gaskets a minimum of 3-1/2 inches by one inch; and for helical joints with one inch depth corrugations: either a single gasket a minimum of five inches by 1-1/2 inches or two gaskets a minimum of 3-1/2 inches by 1-1/2 inches.

3) Such other gasket designs as may be approved by the ENGINEER.

C. If, in lieu of a single gasket spanning the joint, two gaskets are used, these individual gaskets shall be placed approximately two inches from each pipe end at the joint. When two gaskets are used, the overlapping area on the coupling band between the gaskets shall have a soil/watertight joint. A strip of preformed gasket material may be tucked over the bottom lip of the band for this purpose. The coupling bands shall provide a minimum circumferential overlap of three inches. As the end connections on the coupling band are tightened, there shall be no local bending of the band or the connection. Coupling bands on pipe diameters of 24 inches or less shall be procured.

D. All flat gaskets shall conform to ASTM D 1056, designation SCE 42 or 43. In placing flat gaskets on pipe prior to placing the coupling band, the gasket shall not be stretched more than 15 percent of its original circumference. All circular gaskets shall conform to ASTIVI C 361. The circular gasket shall not be stretched more than 20 percent of its original circumference in placing the gasket on pipe.

8. ALTERNATE JOINTS

A. In lieu of the above-specified combination of locking bands and flat gaskets, the field joints for these pipe installations may be made by the following combinations.

B. The Metal Bands shall be as specified in Article 20.1 of AASHTO M 36-70. They shall be at least 10-1/2 inches in width, and shall consist of a flat central section, with a corrugated section near each end, designed to match the annular corrugation in the pipe with which they are to be used. The bands shall be drawn together in a manner approved by the ENGINEER, with a suitable fastening device such as the use of two galvanized 1/2 inch diameter bolts, through a galvanized bar and galvanized strap suitably welded to the band. The strap shall be the same gauge as the band. Where helically corrugated pipe is to be jointed by this alternate combination, at least the last two corrugations of each pipe section shall be annular, and designed such that the band will engage each pipe end with the next to-outside annular corrugation.

C. The gasket used with these bands shall be a rubber gasket, of circular cross-section, of the 00-ringe type, conforming to ASTM C 361. The gaskets shall have the following cross sectional diameter for the given size of pipe.

128 through 36" - with 1/20 depth corrugations - 13/160
426 through 969 - with 1/28 depth corrugations - 7/80
360 through 1209 – with 1” depth corrugations - 1-3/89

Preformed gasket material shall be used to seal the overlapping area on the coupling band between gaskets.

D. Channel bands couplers may be used in helical pipe with ends which have been reformed and flanged specifically to receive these bands. The channel band couplers shall:

1) Be of two piece design.
2) Be fabricated from galvanized steel stock conforming to AASHTO M 36.
3) Be 0.079 inch thickness for pipe of 0.109 inch or lighter.

4) Be 0. 109 inch thickness for pipe of 0. 138 inch or heavier.
5) Be 3/4 inch wide for pipe of 0.109 inch or lighter.
6) Be 1 inch wide for pipe of 0.138 inch or heavier.
7) Have 2 inch x 2 inch x 3/16 inch angles securely fastened to the band ends to allow for proper tightening.

Two 1/2 inch diameter connection bolts shall be furnished with each band. These bolts shall conform to ASTM A 307, grade A and shall be electroplated in accordance with ASTM A 164, Type RS. The gasket used with the joint shall be a hydrocarbon blend of butyl rubber.

E. The flange band coupler may not be used to join dissimilar types of pipe.

9. BITUMINOUS COATING AND PAVED INVERT

A. When bituminous coating is specified, the pipe or pipe arch, shall be coated in accordance with the requirements of AASHTO M 190, for Type A (Fully Bituminous Coated).

B. When bituminous coated and paved invert are specified, the pipe or pipe arch shall be coated and paved in accordance with AASHTO M 190, for Type C (Fully Bituminous Coated and Paved).

10. PAVED INTERIOR

A. When bituminous coated and paved interior are called for the coating and paving shall meet the requirements specified above for bituminous and paved invert (Type C), with the following additions and exceptions:
1 The smooth pavement formed by the asphalt cement shall extend over the entire interior of the pipe.
2) The exterior coating and the interior paving shall be applied over asbestos bonding or equal.
3) No markings will be required on the outside of the pipe to designate the centerline of the top of the pipe.
4) Lifting lugs shall be attached to the pipe, and shall be suitably placed to facilitate moving the pipe without damage to the exterior or interior bituminous material.

11. BASIS OF ACCEPTANCE OF BITUMINOUS COATING AND PAVING

A. The acceptance of the bituminous coating, paved invert, and paved interior will be based on the ENGINEER's visual inspection.

B. Manufacturer's certified mill tests may be requested.

12. UNDERDRAIN PIPE

A. Corrugated metal pipe for underdrain shall conform to the requirements of AASHTO M 36 except that Class IV pipe, as specified in Article 18.1.1.4 therein, shall not be used.

13. TRENCH CONSTRUCTION

A. Trench construction shall be performed in accordance with the requirements of Section GM-04 and as shown on the Drawings.

B. Except where specifically required or approved by the ENGINEER or ' otherwise shown on the Drawings; Class C2 shall be provided for corrugated steel pipe.

C. CLASS C2 EMBEDMENT

1) The pipe shall be bedded with “ordinary” care in an earth foundation formed in the trench bottom by a shaped excavation which will fit the pipe barrel with reasonable closeness for a width of at least 50 percent of the outside pipe diameter.

2) Initial backfill material, which is from the bedding to one (1) foot above the pipe:

   a. Shall be carefully deposited in successive horizontal layers of not more than twelve (12) inches in loose depth on each side of the pipe.

   b. Shall be thoroughly and carefully tamped or rammed around the pipe with approved tools until reaching a cover of not less than one (1) foot over the top of the pipe.

D. All final backfill for trenches shall be in accordance with Section GM-04 of these Specifications unless otherwise specified under this section.

14. AUGNMENT

AL Maximum permissible variation in pipe alignment and grade shown on the Drawings shall be:

1) Alignment = 1 ft. per 100 ft.

2) Grade = + 0.10% from the horizontal plane

15. LAYING AND SHAPING REQUIREMENTS FOR CORRUGATED STEEL PIPE

A. Upon completion of the project and just prior to acceptance by the OWNER, coated corrugated steel pipe shall be cleaned and inspected for breaks or other damage to the coating or to the pipe itself, and any repairs necessary shall be made. When the pipe is laid, the interior shall be reasonably uniform and as near circular as is practical.

B. The vertical diameter shall not be less than 100 percent nor more than 105 percent of the nominal diameter, and the horizontal diameter shall not be less than 95 percent nor more than 100 percent of the nominal diameter.

C. All measurements for the above dimensions shall be made at the surface of the coating, at the point of smallest diameter on the corrugations.

END OF SECTION - SD.02

SD.03 - PREFABRICATED HEADWAU.S AND GRATES

1. DESCRIPTION

A. This Section covers the requirements of furnishing a prefabricated pipe culvert end section including a metal safety grate.

B. Prefabricated pipe culvert headwalls shall be for flexible pipe with metal sleeve or metal end section.

2. QUAUTY ASSURANCE

A. Manufacturer shall produce headwalls and safety grates of satisfactory quality to meet the requirements of these Specifications.

B. All concrete end sections shall meet the requirements of AASHTO M-170, Class III pipe.

3. REFERENCED STANDARDS

A. AASHTO M-170: Class III Reinforced Concrete Pipe.

B. ASTM A-123: Hot-Dipped Galvanized Grates.

C. AASHTO M-36: Metal Pipe Fabrication.

4. SUBMITTALS

A. Submit three copies of full details of headwalls and grates prior to fabrication.

5. MATERIALS

A. HEADWAH
   1) Concrete end sections shall comply with the requirements of Class III pipe and as shown by the Drawings.
   2) Unless otherwise specified, all headwalls; shall meet the requirement of the Florida Highway Department Standard Specifications for Highway Construction.
   3) Concrete end sections shall have metal sleeves to match the same pipe materials as specified in the base bid.

B. SAFETY GRATES
   1) Safety grates shall be fabricated from metal plates conforming to ASTM A-36 steel.
   2) Grates shall be hot-dipped galvanized after fabrication in accordance with ASTM A 123.
   3) Grates shall meet or exceed the requirements of the Florida Highway Department Standard Specifications for Highway Construction.

C. BANDS
   1) Headwall supplier shall supply bands to connect to pipe as specified in the base bid.
   2) Suppliers of alternate bid materials shall be responsible for supplying proper bands for the connection of their pipe to the headwalls.

END OF SECTION - SD.03